

entirely the results of his own observation. And a thoroughly good and most original observer he is, with a faculty of telling what he has seen in such a way as keeps the reader in a constant state of exhilaration. Lord Campbell makes no pretence at instruction, nevertheless in his own characteristic and irresistibly amusing way, he conveys a vast amount of information concerning all the places visited by the *Challenger*, and tells not a little of the results of the soundings and dredgings carried out by the "scientifics," as he calls the civilian staff. But apart from the genuine entertainment to be had from the work, its great value will be the observations made by the author on the various peoples among whom he sojourned for a longer or shorter period. Even well-informed ethnologists, we should think, will be able to obtain not a little important information from the work on the present condition, for example, of the inhabitants of many of the Pacific islands, such as those of the Friendly, Fiji, and Sandwich Islands, New Guinea, Admiralty Islands, &c. A very large space is devoted to Japan, and many shrewd remarks made on the present condition and future prospects of the Japanese. There are many interesting notes besides, on the physical aspect and natural history of most of the places visited, and in almost all cases it will be found that some new feature has been brought out. Even of such well-worn subjects as Teneriffe, the Azores, Cape de Verde Islands, Australia, New Zealand, Tahiti, the South American littoral, Lord Campbell manages to say something unexpectedly original. In a concluding chapter he gives an instructive summary of the *Challenger's* work and how she did it. We can only, in our space, speak in the most general way of the nature of the contents of this work. A more entertaining, a more genuinely bracing book, it would be difficult to find, and the reader who goes carefully to the end of it will have added considerably to his knowledge of the earth's surface. It is a great pity that a work so full of varied information should have been published without either an analytical table of contents or an index. A map would also have been a great help to the reader.

Mr. Spry professes simply to give a plain, straightforward narrative of the cruise, of some of the chief results obtained by sounding and dredging, with notes on the places and people visited, partly the result of his own observation and partly of reading. The book is nicely got-up, well printed, and contains a large number of interesting and well-executed illustrations, not only of people and places, but of the implements used in carrying out the work of the *Challenger*. He gives a very clear account of the various apparatus used, their construction and uses, which we commend to the perusal of the uninitiated reader who wants to know how such work as that of the *Challenger* is performed. Mr. Spry gives the curious story of the brothers Stoltenhoff, who were found living alone on Inaccessible Island, at considerable length, in the words of the elder brother. The work contains a really large amount of valuable information, and as no two men observe alike, we commend those who desire to have complete information about the cruise of the *Challenger*, to read both books. While Mr. Spry sometimes unnecessarily introduces information obtained from books, his work is, on the whole, thoroughly readable,

and certainly instructive. Altogether, these preliminary "snacks" augur well for the great official feast which is being prepared for us.

OUR BOOK SHELF

The Year-Book of Facts in Science and Arts for 1876.
Edited by James Mason. (London: Ward, Lock, and Tyler, 1877.)

THE "Year-Book of Facts" so long associated with the name of the late indefatigable Mr. Timbs seems to have taken a new lease of life under the present editor, who begins his duties with the volume before us. Some useful changes have been made; thus, there is a marked improvement in the arrangement and character of the contents, and the period covered by this year-book now extends from the autumn of one year to the autumn of the following, and not January to December as heretofore. The longer time thus given for preparation has been well used by Mr. Mason, who certainly has produced a volume far in advance of any of its predecessors. It is hardly necessary for us to say much about this well-known year-book, which does not pretend to be more than a popular digest of scientific scraps; and in no sense supplies the need, to which we have alluded in previous notices, of a carefully-prepared record of scientific progress—the nearest approach to which in the English language is the American "Annual Record of Science and Industry," edited by Mr. Baird. The present editor of the book before us has done his work, so far as it goes, in a comprehensive and careful manner. One or two serious omissions we notice, notably the important discovery made by Dr. Ker, and announced at the last meeting of the British Association, of the rotation of the plane of polarisation by reflection from a polished magnetic pole, certainly one of the most novel physical facts of the past year.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

Just Intonation

YOUR esteemed correspondent, Col. A. R. Clarke, declines to admit any error or oversight in his communication to NATURE under the signature of "A. R. C.," on December 21, 1876. I regret to be of a different opinion. The first error which I pointed out ought to be palpable enough to a mathematician who is acquainted with the ratios of a scale, and therefore I treated it as an oversight. Col. Clarke gives 27 to 16, instead of 5 to 3, as the ratio for A in our present diatonic scale. By his enlargement of the interval he would unknowingly convert the well-known consonance of a major Third between F and A into a Pythagorean ditone. Evidently the Colonel is not aware that F and A are notes *interposed* in the scale of C, that harmonically they belong to F, and require F as a consonant bass. All this has been explained in a pamphlet in print. I would therefore suggest to Col. Clarke an investment of sixpence in the purchase of a "Review of Helmholtz's New Musical Theories," published by Novello, Ewer, and Co., No. 1, Berners Street. To prove all the unadmitted charges would be too long for NATURE, and Col. Clarke will find most of them touched upon in that pamphlet as well as other current errors. In the meantime it is not difficult to tell that Col. Clarke derived his ratio from the harmonic scale of C, and not from that of F (which would have been right), or from the work of any modern mathematician.

It is because F and A are harmonically derived from F that our scale cannot be reduced to a common denominator. The F string exceeds the length of the C string by half, the ratio being 3 to 2, and one of the first rules of proportion is that

"ratio can exist only between quantities of the same kind." When mathematicians employ the figures of 4 to 3 in the scale of C, the interval they really obtain is from C down to G (not from F down to C, as they have supposed), and when 5 to 3, they have the major Sixth from E down to G, and not the one from A down to C.

Music is a much more simple science than most men suppose. All that a mathematician requires is a set of harmonic scales, with powers of 2 and 3, before him. The scales include all ratios, and all consonances with their proportions of accompanying dissonances. They are scales of aliquot parts, and those aliquot parts are the corresponding multiples of vibrations. Time spent upon calculating temperament is but thrown away, because no mathematician's figures will be adopted in practice. Practical musicians will continue to tune by listening to the beats, as they have ever done, and perhaps all other musicians before them. The recommendation to eschew temperament may be even worthy of consideration in another point of view. Mathematicians have not given sufficient attention to the musical side of the question. Have we not, of late years, heard much of proposals to divide the octave into "twelve equal semitones"? Are we to imagine that this is a mathematician's idea of "equal temperament"? If music were but geometry, it would be an admirable arrangement: twelve equal semitones, like twelve equal inches in a foot. But, unfortunately, a musical scale is the very reverse of a geometrical one, and there are no two intervals alike in it. As it rises, the dimensions become less at every step, in ratio and in length. For instance, the ratio of C to C sharp is 16 to 17, that of G to G sharp (G being the half-way in point of vibrations) is 24 to 25, and from B to octave C is 30 to 32, but only because we omit B sharp, otherwise it would be 31 to 32. Fancy two such extremes "tempered" to the middle note! Only one of the twelve would fit into a musical scale, and there would be eleven discordant semitones out of the twelve. The discord would not be confined to one key only, but would be the same in every key. The so-called "diatonic semitones" are really tones. E is the seventh to F, which requires F as a bass, and B is the seventh to C in the scale of C. Are these to be changed into chromatic semitones?

The diminished attraction of music, some persons even disliking it, is mainly, if not wholly due to tempered tones. The first point to be considered by mathematicians who temper scales is the meaning of the two words, "consonance" and "dissonance." The charm of music depends upon "coincident," and "non-coincident" vibration.

In justice to Col. A. R. Clarke, let me add that I find only the first error to be his own, and am still disposed to attribute it to oversight in referring to a wrong scale. All the others are after precedent, and every source might be pointed out, although he is disposed chivalrously enough to defend those upon whom he relied. My excuse for writing at all is that NATURE is a purely scientific journal, and that I share with others an earnest wish to uphold it as a fair representative of English thought. Articles such as those of Col. Clarke and my own would be distasteful to any but scientific readers. As to the "comma of Pythagoras," it is not worth discussing. In spite of his chivalry, Col. Clarke knows as well as I do, that such an array of figures, representing vibrations, as 524, 288, cannot arise in less than nineteen octaves.

WM. CHAPPELL

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The Nebula of Orion

IN NATURE, vol. xv. p. 201, in an account of the American Cambridge Observatory, it is stated that the nebula of Orion had not shown the slightest trace of resolvability under Lord Rosse's 3-feet reflector.

The authority for this statement is, I suppose, Nichol's "Thoughts on the System of the World," where, p. 52, it is said that in 1844-5, the 3-feet did not contain the vestige of a star in the nebula.

On the occasion there referred to the speculum must have been in bad order, for the resolution of parts of the nebula is quite within the reach of the instrument in its normal condition. In proof of this I may refer to Lord Oxmantown's paper on the Nebula of Orion, *Phil. Trans.*, 1861, and to an extract from my own note-books of an earlier date, February, 1848:—"With the 3-feet saw the nebula of Orion resolved as far up as the little bay and C 1 Orionis—powers 351 and 320—best with the latter which is a single lens."

I may add that Nichol also states, p. 55, that he had received from Lord Rosse, March 19, 1846 intelligence "that all about the trapezium is a mass of stars (in the six feet); the rest of the nebula also abounding with stars, and exhibiting the characteristics of resolvability strongly marked."

Observatory, Armagh, January 19

T. R. ROBINSON

Basking Shark

MY notice of Prof. Steenstrup's paper was written in the autumn of 1875, to accompany an electrotype of the woodcut in that paper of the baleen-like fringes of the basking shark, sent to me for NATURE from Copenhagen.

At the time I was quite ignorant that my friend and former master, Dr. Allman, had written on the subject, nor could the keenest bibliographer have known much of the contents of his memoir, as the only reference to it in the Fourth Annual Report of the Dublin Natural History Society for 1841-42, is "Two [papers] have been read on Ichthyology; that on the basking shark (*Selachus maximus*) by Mr. Allman, caused him to notice the value of the fisheries of our southern coasts, abounding in large fishes and cetacea, whose capture would prove highly profitable to our fishermen from the quantity of oil they would yield." In June, 1876, on the arrival of the specimen in Dublin from Bofin, I had a woodcut made of a branchial arch with the fringe attached, and added a brief account of the specimen now in the Dublin Museum. About that time Dr. Allman told me that notes of his paper had been published in the *Saunders's News Letter*, but that he had forgotten the date. Guided by the notice in the Dublin Natural History Society's Report, I searched the files of that paper for the years 1841 and 1842 without success, but I fully purposed to mention what Dr. Allman had told me, from memory, of his researches, when I should get a proof of my manuscript. Unfortunately, from press of matter, my notes were not published until many weeks after they were sent, and the proof reached me during long vacation, when I completely forgot to do as I had intended. I regret this exceedingly, and hope Dr. Allman will accept my apology. I cannot, however regret, that it has induced Dr. Allman to publish an abstract of his paper (NATURE, vol. xiv. p. 368), and perhaps he may still further furnish us with the date of its original publication.

In answer to the note of Prof. Enrico Giglioli, which has called my attention again to this subject, I have simply to state that finding no notice in the Zoological Records for 1873 or for 1874 (this latter published May, 1876) of any papers on *Selache*, I concluded, as it now appears wrongly, that nothing had been written during these years on the subject. This was my misfortune, perhaps my fault; but regarding Italy as the mother country of all the sciences, being well aware of the advances she has made in biological researches during the last twenty years, and having gone each year, while one of the zoological recorders, to Florence to work out the Italian literature of the preceding year, I cannot accuse myself of any intentional neglect of the labours of Italian biologists. It is to be hoped that Prof. Giglioli will favour us with an abstract of Prof. Pavesi's memoir, especially of the reasons that induce Prof. Pavesi to assert that our Bofin shark is *S. rostrata* and not *S. maxima*, for to me it appears that our seas may possess both these species.

It may also be mentioned that no reference to Prof. Pavesi's memoir will be found in the account of the Pelerin appended to Prof. Lütken's "Fishes of Greenland," prepared for the use of the British North Polar Expedition, 1875.

E. PERCIVAL WRIGHT

Sense of Hearing in Insects and Birds. "Towering" of Birds

I AM glad to learn from Mr. McLachlan that stridulation is known to occur in several species of *Lepidoptera*; for this shows that the sense of hearing in these insects is probably of general occurrence. With regard to the sense of hearing in birds, I did not say in my previous letter that thrushes, &c., were guided to their food *exclusively* by this sense; indeed it would be a very anomalous thing if animals which possess so keen a sense of sight are not in the habit of using it, as Mr. McLachlan suggests, in any profitable way they can. But that thrushes trust *very largely* to their sense of hearing in their search for food—especially in certain conditions of the ground—no one, I think, who has observed the process can doubt. The bird runs rapidly some twelve to twenty feet in a straight line; it then stops